City/County Assessments: Philadelphia and EMS-HAP

Preparing Emission Inventories for Community Scale Assessments: Introducing EMS-HAP Version 3 and its use for the Philadelphia Project

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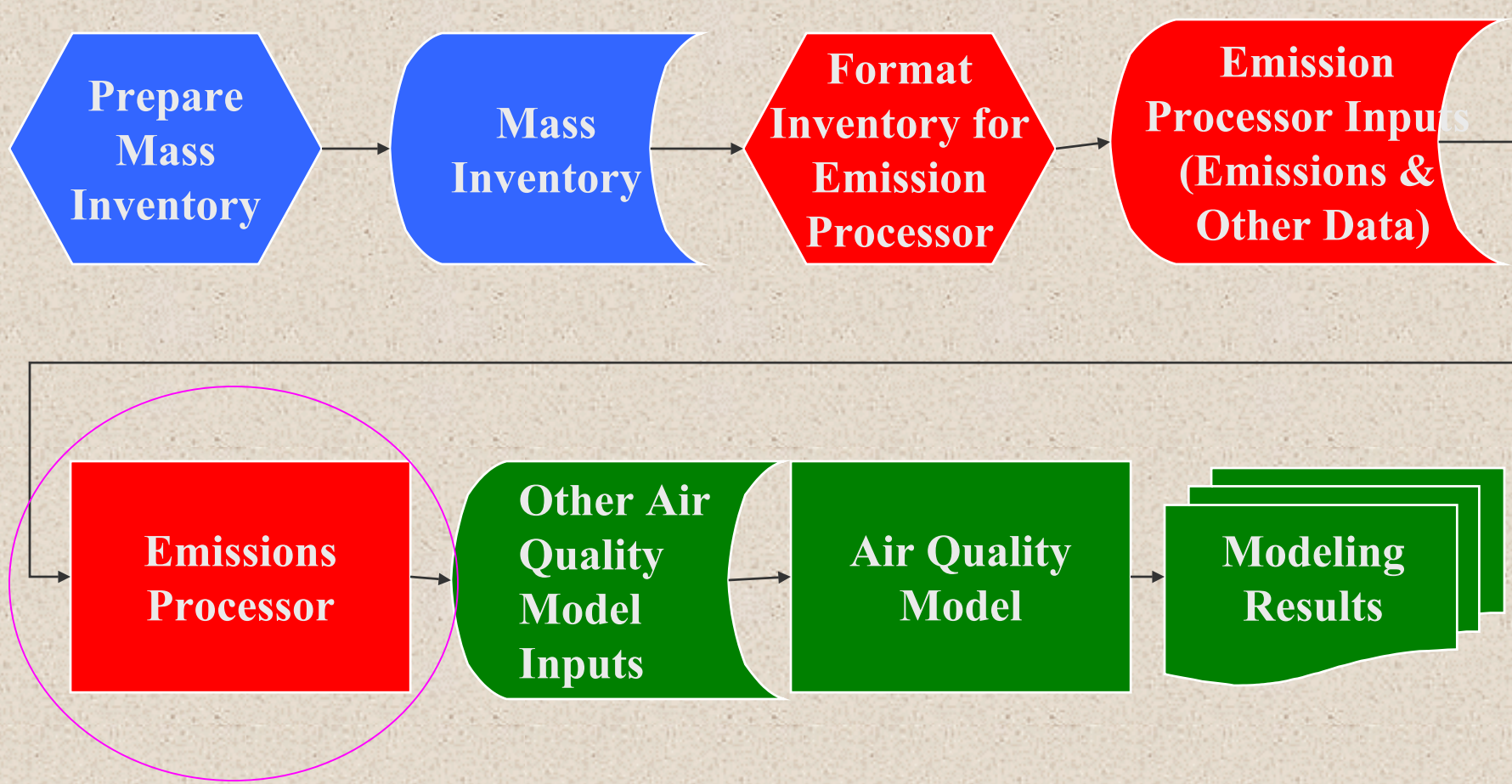
Region 5 Air Toxics Risk Assessment Modeling Tools Symposium
Chicago, Illinois, July 16, 2003

Outline

- Review from yesterday
- EMS-HAP
  - History & Features
  - Functions
  - User's Guide
- Using EMS-HAP for Philadelphia

The Big Picture



Commonly Used Emission Models/Processors

For criteria pollutants

EMS95/2000, 2001

SMOKE

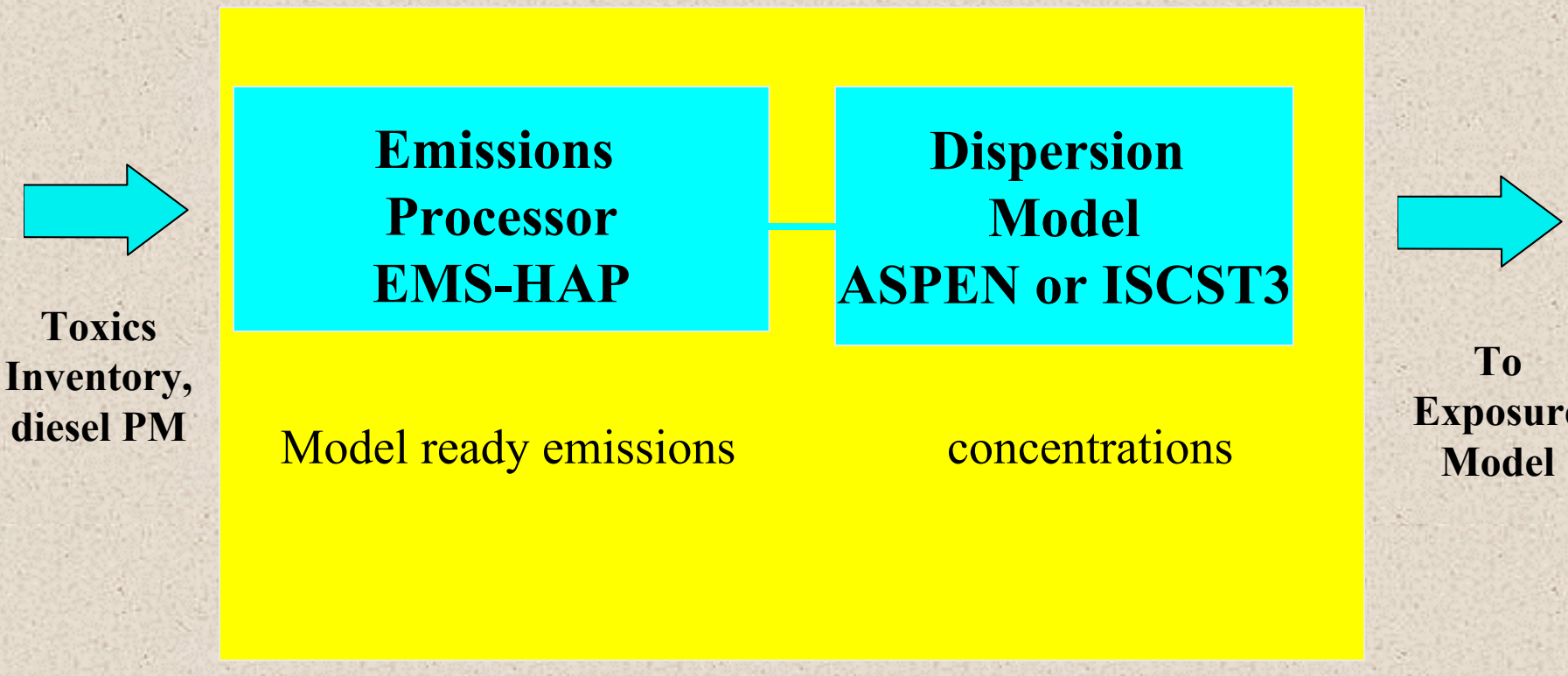
EPS2.5

For toxic pollutants

EMS-HAP

SMOKE (upcoming)

EMS-HAP is Part Of Our Ambient Air Quality Modeling Tools For Toxics



History of EMS-HAP

Version 1: Obsolete

Version 2: Prepares for ASPEN and ISCST3.
Geared for the 1996 NATA inventory

Version 3: Prepares for ASPEN and ISCST3.
1996 NATA inventory, 1999 NEI and later

Applications: 1999 NATA and all future community scale and projection work.

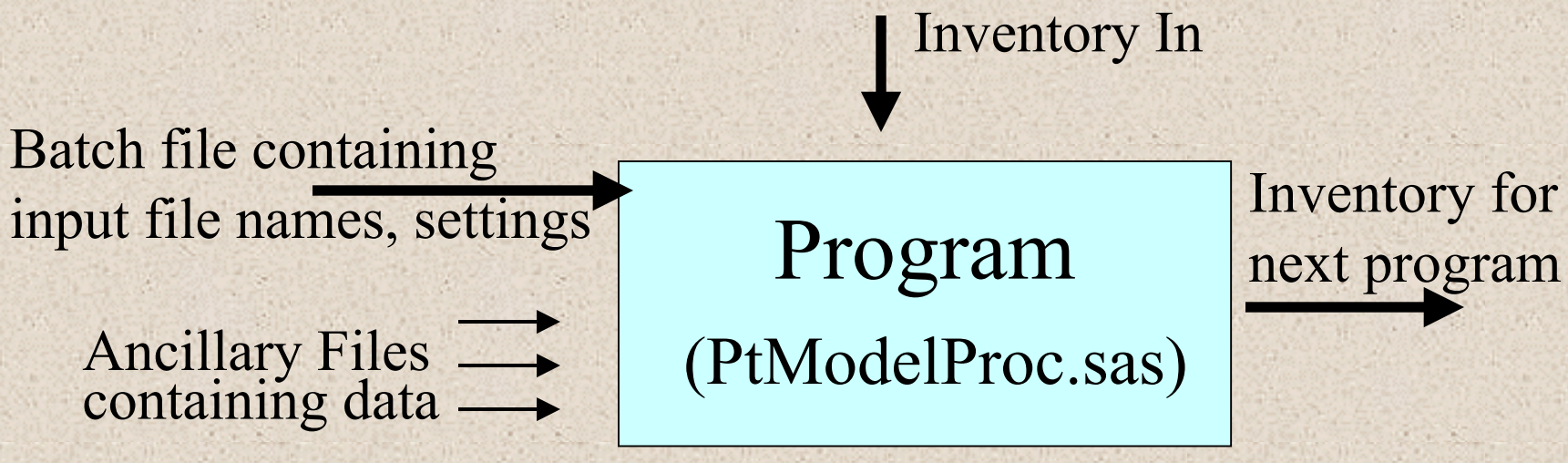
Version 3 code available but not yet on website, User's Guide is still draft.

Features of EMS-HAP

- SAS Programming language – Version 8
- Inventory must be input as a SAS data file
- Designed for UNIX but can be adapted for PC
- Processes point, non-point, nonroad and on-road emissions
- Cannot run MOBILE6 but can use link-based MOBILE6 generated emissions for temporal allocation and inclusion in ISCST3 SO Pathway File

Features of EMS-HAP…continued

- Multiple programs, run in sequence for each section of the inventory: point, non-point, non-road and on-road



- We supply example batch files and many of the ancillary files you will need

County – to – Point processing: extract certain county level sources and allocate to known locations

QA Locations & Stack Parameters

Model specific parameters

Selection, Partitioning and Grouping of Pollutants with optional source-based speciation

Spatially Allocate non-point & mobile source emissions

Temporally Allocate Emissions

Project Emissions

Assign Source Groupings

Format & Output Air Dispersion Model-Ready Emission-Related Inputs

Functions of EMS-HAP

County – to – Point Processing

- Allows airport-related emissions to be modeled at specific locations rather than gridded
- Airport location data and allocation factors supplied with EMS-HAP
- Airport dimensions supplied by user
- Code general enough to include other sources such as landfills and ports

Location & Stack Parameter QA and Model-specific Defaulting

- EMS-HAP does not default locations when processing for ISCST3; but converts lat / lon to UTM and drops records with missing coordinates
- EMS-HAP can default stack parameters by SIC and SCC, but if your inventory is from the NEI, that has been done already
- Fugitives and horizontal stacks don't use stack parameters: EMS-HAP "defaults" as ISCST3 volume sources: 2 meter release height, sigmax and sigmaz = 1.5 meters
- All stacks less than 65 meters are given building dimensions

Grouping Metal Compounds for Toxics Modeling in EMS-HAP

The HAP table groups, partitions and selects pollutants

Example: Arsenic Coarse and Fine Pollutant Groups

Name of Species	Description of HAP	Inventory Pollutant Code	React-ivity	KEEP	HAP CODE	Factor
Arsenic pentoxide	Arsenic cmpds coarse	1303282	3	y	48	.2673
Arsenic acid	Arsenic cmpds coarse	1327522	3	y	48	.2164
Arsenic Trioxide	Arsenic cmpds coarse	1327533	3	y	48	.3105
Arsenic	Arsenic cmpds coarse	7440382	3	y	48	.41
Arsine	Arsenic cmpds coarse	77884421	3	y	48	.41
Arsenic & compounds	Arsenic cmpds coarse	601	3	y	48	.41
Arsenic pentoxide	**Arsenic cmpds fine**	**1303282**	**2**	**y**	**48**	**.3846**
Arsenic acid	Arsenic cmpds fine	1327522	2	y	48	.3114
Arsenic Trioxide	Arsenic cmpds fine	1327533	2	y	48	.4469
Arsenic	Arsenic cmpds fine	7440382	2	y	48	.59
Arsine	Arsenic cmpds fine	77884421	2	y	48	.59
Arsenic & compounds	Arsenic cmpds fine	1303282	2	y	48	.59

Speciating Chromium Compounds for Toxics Modeling in EMS-HAP V3

Specific HAP table can speciate using category specific data

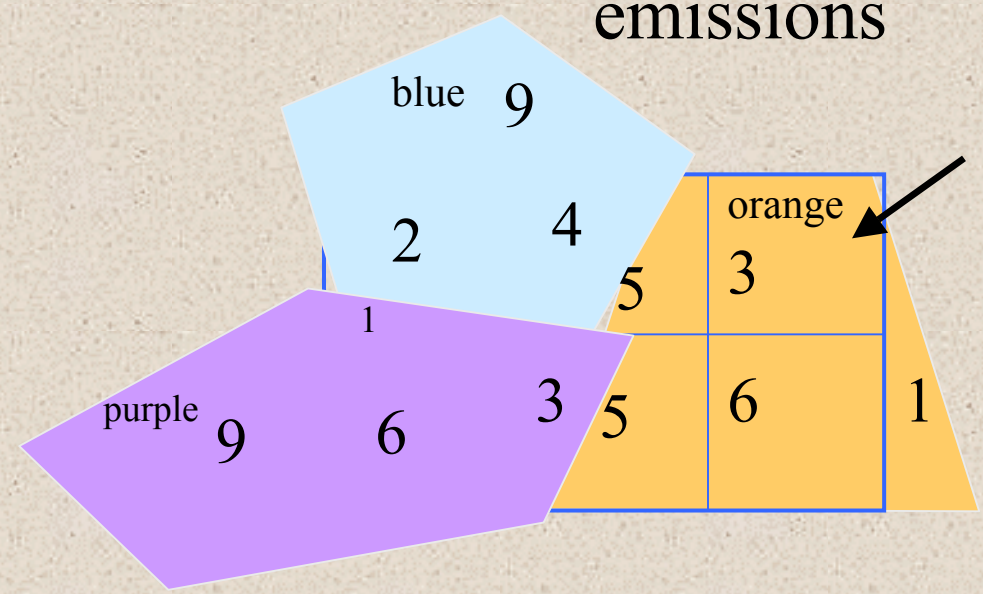
Sample records in file supplied with EMS-HAP V3

Speciated HAP	CAS	OldS1	NewS 1	OldS2	OldS3	NewS3	SPECF X	MACT	SCC	SIC
Trivalent chromium	136	80141	5992	80341		5993	.66			
Hexavalent chromium	136	80141	6992	80341		6993	.34			
Trivalent chromium	136	80141	5992	80341		5993	.72			2431
Hexavalent chromium	136	80141	6992	80341		6993	.28			2431
Trivalent chromium	**136**	**80141**	**5992**	**80341**		**5993**	**.44**	**0107**		
Hexavalent chromium	**136**	**80141**	**6992**	**80341**		**6993**	**.56**	**0107**		

Spatial Allocation of County-level Emissions

Concept: use surrogates to allocate county level emissions for county-level sources

e.g., use population data to allocate consumer product emissions



This Grid cell gets 3/20 of Orange county's consumer product emissions

Temporal Allocation of Emissions

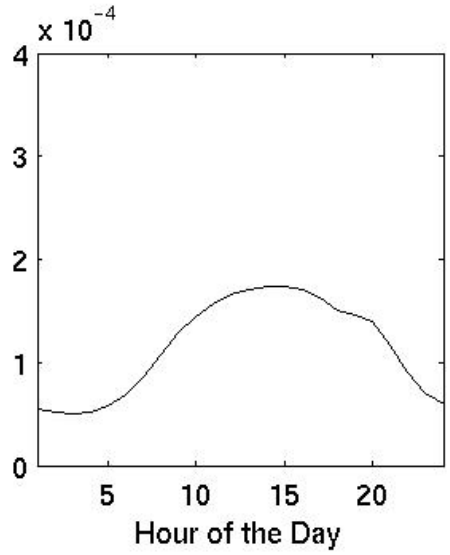
Typically from annual (inventory) to what model needs

ASPEN → **hourly (every day is treated the same)**

ISCST3 → **24-hourly, 4 season, 3 day type factors**

Use temporal profiles or operating data

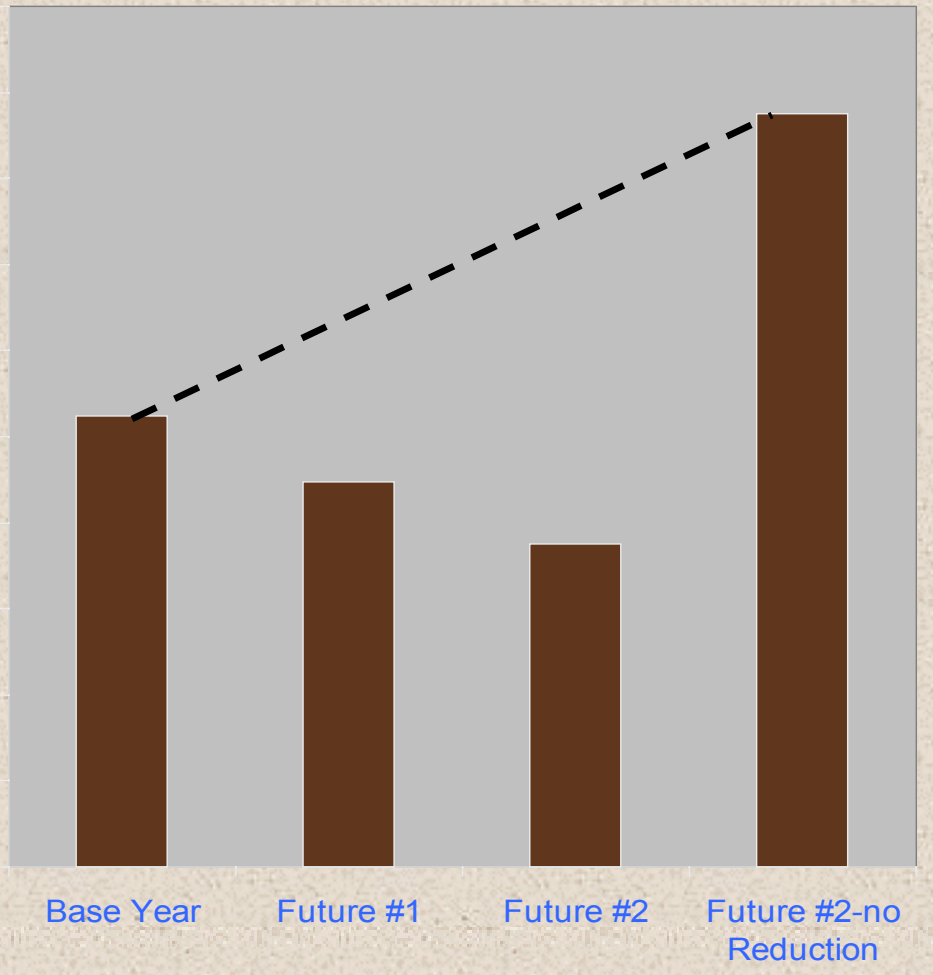
Example: temporal profile for aircraft emissions, for summer weekday

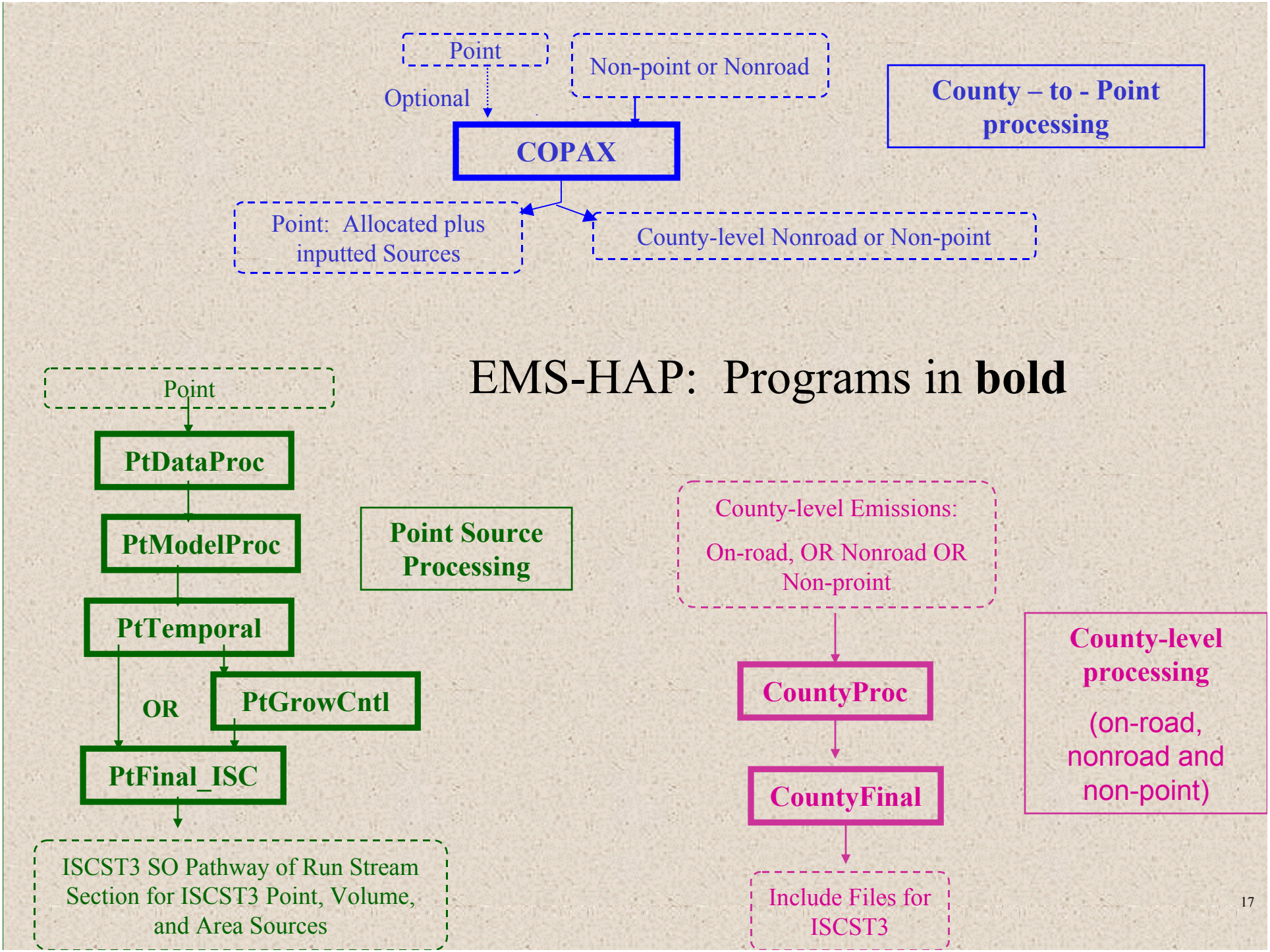


Projection of Inventory to Future Years

Apply growth and future emission reduction scenarios

Example Use of Projection Function




Point
Optional
Non-point or Nonroad
COPAX
County – to - Point processing
Point: Allocated plus inputted Sources
County-level Nonroad or Non-point
EMS-HAP: Programs in bold
Point
PtDataProc
PtModelProc
PtTemporal
OR
PtGrowCntl
PtFinal_ISC
Point Source Processing
ISCST3 SO Pathway of Run Stream Section for ISCST3 Point, Volume, and Area Sources
County-level Emissions:
On-road, OR Nonroad OR Non-proint
CountyProc
CountyFinal
Include Files for ISCST3
County-level processing
(on-road, nonroad and non-point)

EMS-HAP User's Guide

Version 2 is out: gives example applications (NATA and Houston Study)

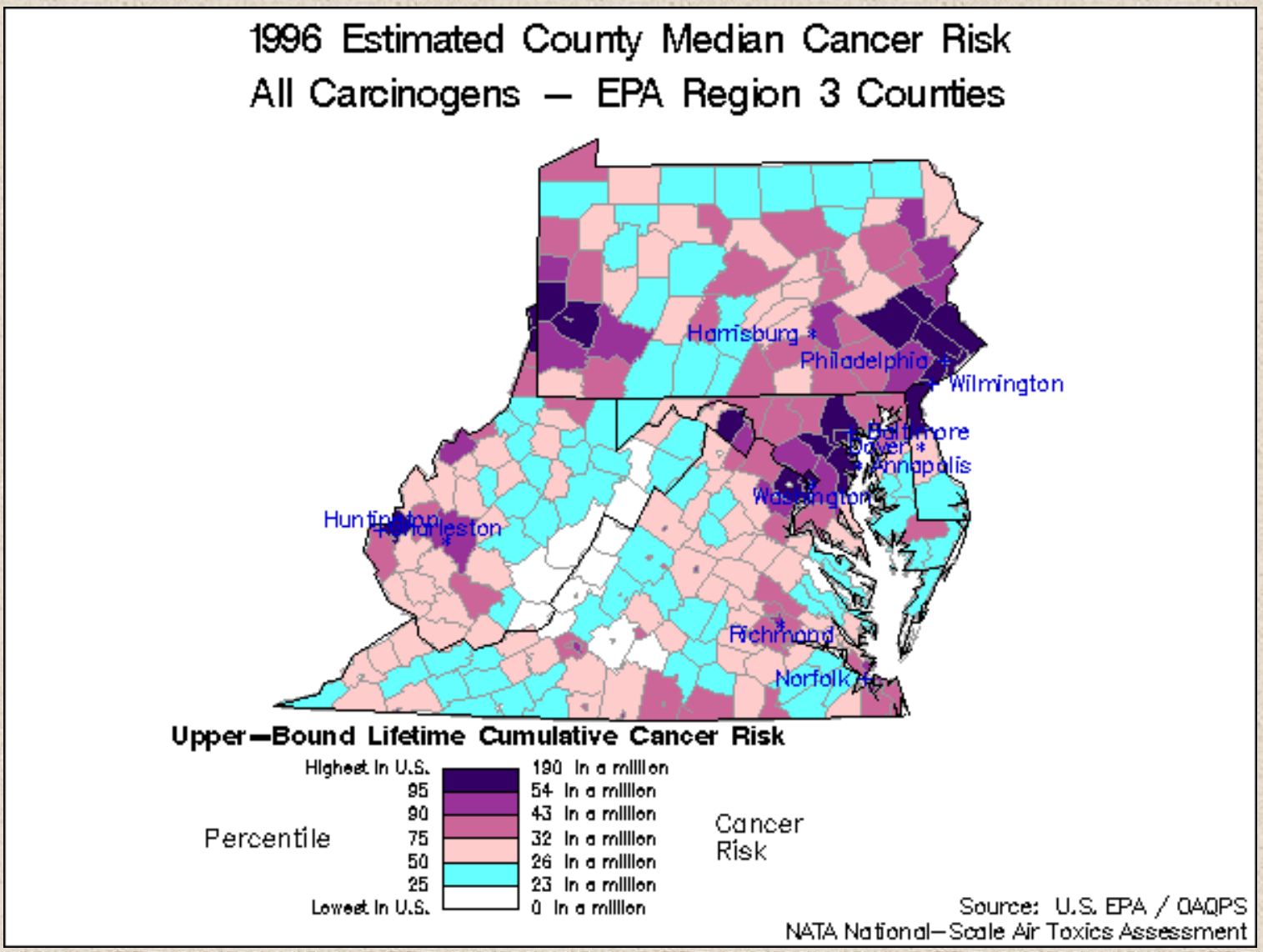
Version 3 still draft – plan to distribute it (draft form) with code to those who are interested

Philadelphia Air Toxics Project

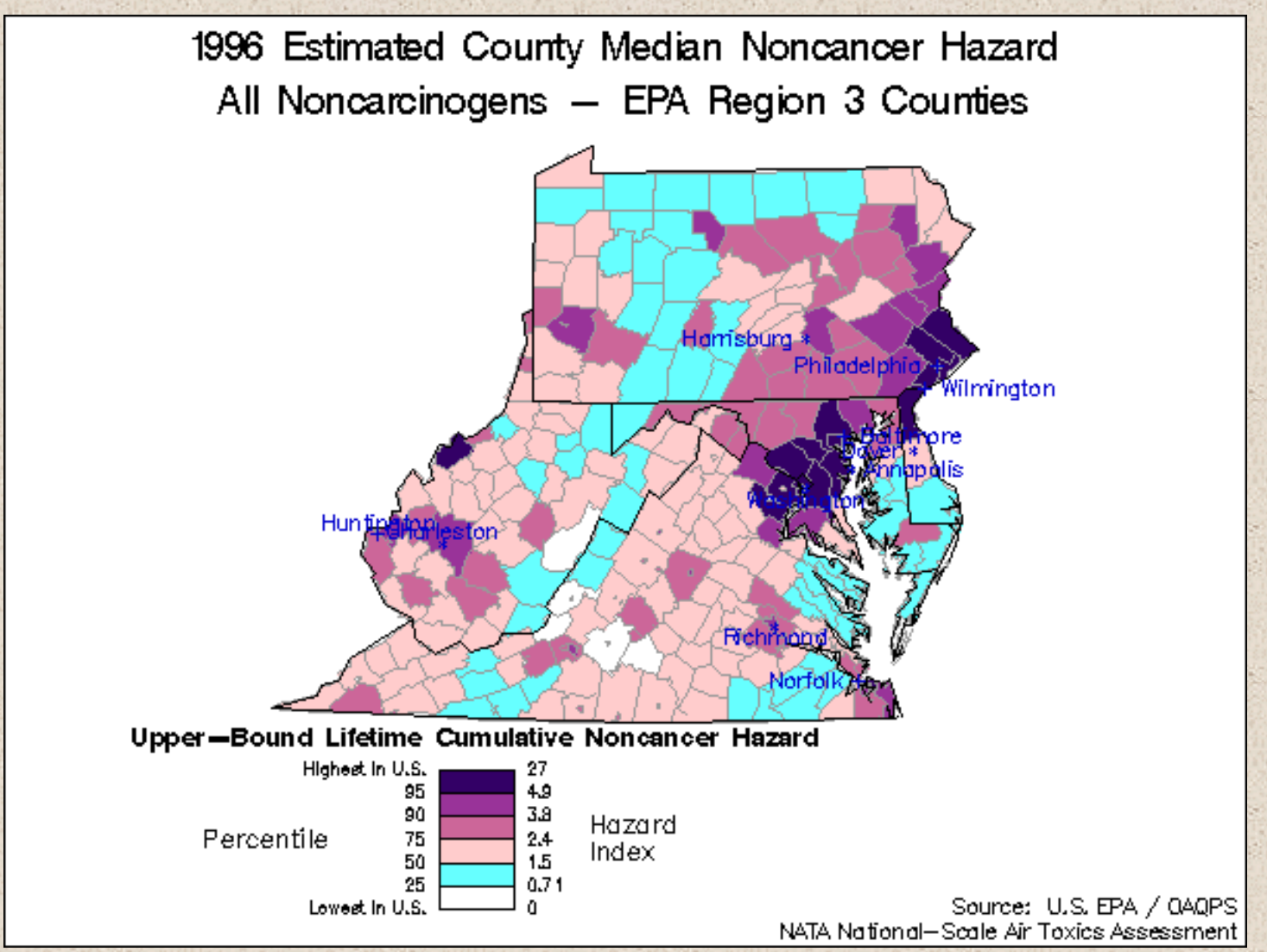
-reasons-

- Philadelphia's residents face health risks from exposure to air toxics which are among the highest in the nation.
- We want to begin acting now to reduce the health risks to the extent possible given our current understanding of the air toxics problem.
- In order to fully understand what actions are required to reduce these health risks, we need to better understand the air toxics problem.

Philadelphia Air Toxics Project



Philadelphia Air Toxics Project



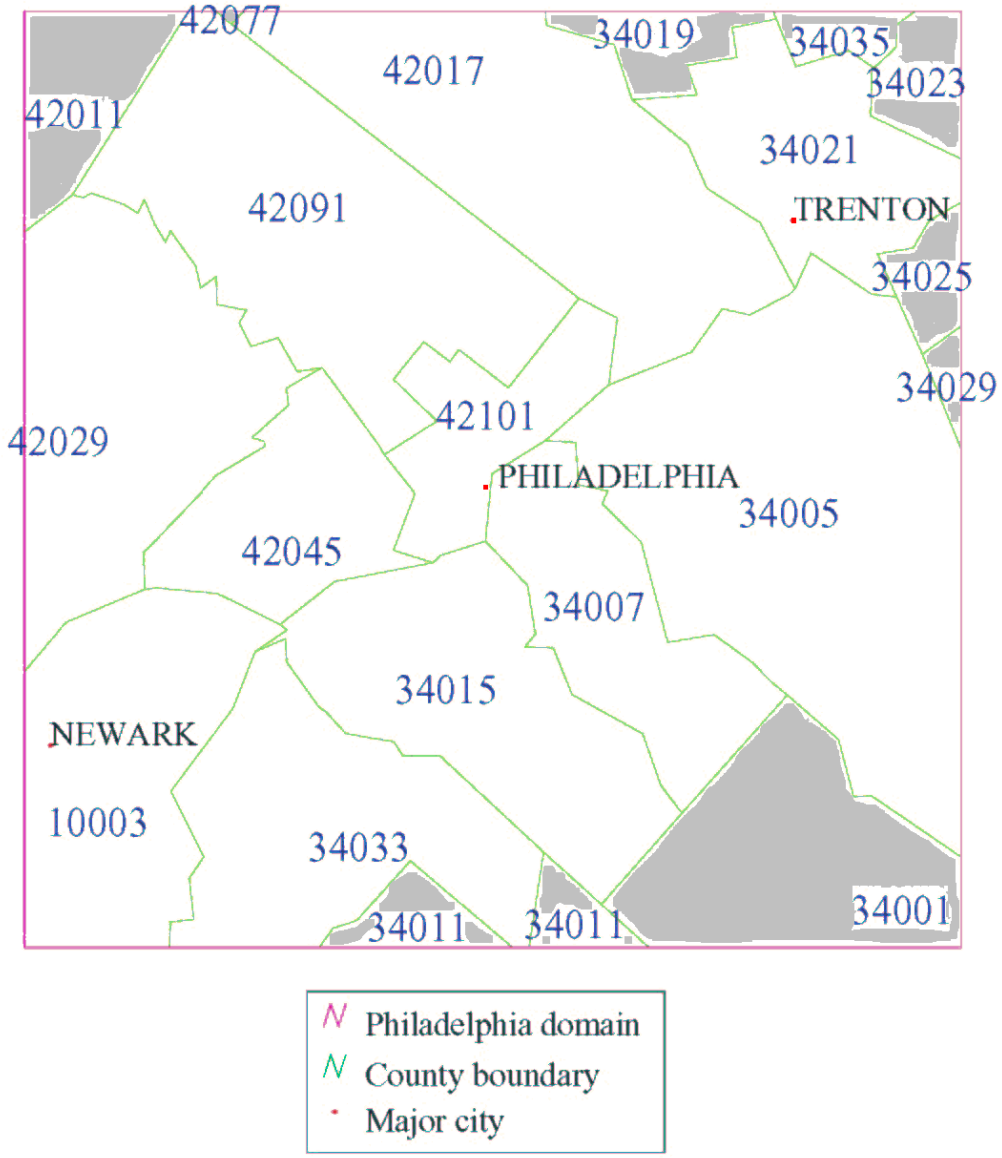
Project Goals

- Encourage sources to voluntarily reduce their air toxics emissions.
- Increase understanding of the air toxics problem by improving emissions, concentration, exposure and health risk estimates.
- Estimate likely air toxics emissions, concentrations, exposure and health risks in the future (considering 2010).
- Inform the public of the air toxics problem and of what they can do to help reduce air toxics emissions. Also, inform the public that they can reduce their exposure to air toxics by reducing indoor air toxics emissions.

Role of EMS-HAP for Philadelphia Study

- Provide model-ready files for use in the SO Pathway of the ISCST3 run stream, utilizing 1996 NATA inventory and Final 1999 NEI for HAPs

Philadelphia Urban Toxic Model Domain



1 by 1 km grid

107 km by 107 km area

Urban HAP	Sources
Acetaldehyde	Mobile and stationary
Acrolein	Mobile and stationary
Benzene	Mobile and stationary
Butadiene (1,3-)	Mobile and stationary
Chromium	Mobile and stationary
Diesel PM	Mobile
Ethylene Dichloride	Stationary
Formaldehyde	Mobile and stationary
POM	Mobile and stationary

Emission Processing for Philadelphia

- Dimensions of airports received
- We properly located sources that were defaulted in the 1996 NATA
- Weren't able to do much with stack parameters due to ID matching problems
- Needed GIS to re-grid surrogate data
- Region 3 staff repeated EMS-HAP runs to match results

Next steps for EMS-HAP with Philly

- Region 3 to lead 1999 EMS-HAP run once inventory is complete
- Region 3 developing new surrogates using newer national data sets
- Small learning curve in going from Version 2 to Version 3
- We will work together on projecting 1999 to a future year

Conclusions

- Increasing interest for national/regional/local air toxics assessments
- Many of the steps to prepare inventories are done systematically by emission processors
- EMS-HAP designed for ASPEN and ISCST3 and has been well maintained
- EMS-HAP is being used and tech transfer (Philadelphia study) is successfully occurring